PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 25 September 2000 (25.09.00)	
International application No. PCT/SE99/02255	**Applicant's or agent's file reference** 103371901
International filing date (day/month/year) 02 December 1999 (02.12.99)	**Priority date** (day/month/year) 03 December 1998 (03.12.98)
Applicant PERSSON, Fredrik et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

30 June 2000 (30.06.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Manu Berrod
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference 103371901	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE99/02255	International filing date *(day/month/year)* 02-12-1999	Priority date *(day/month/year)* 03-12-1998
International Patent Classification (IPC) or national classification and IPC7 B25J 17/02, F16C 11/06		
Applicant ABB AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
30-06-2000	05-03-2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Ender Dag /itw Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE99/02255

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:
pages 1-3 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☒ the claims:
pages _____ , as originally filed
pages _____ , as amended (together with any statement) under article 19
pages _____ , filed with the demand
pages 1-2 , filed with the letter of 2000-12-13

☒ the drawings:
pages 1-5 , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

☐ the sequence listing part of the description:
pages _____ , as originally filed
pages _____ , filed with the demand
pages _____ , filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language ENGLISH which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☒ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE99/02255

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-11	YES
	Claims		NO
Inventive step (IS)	Claims	1-11	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-11	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The invention relates to a robot including a device for eliminating play in a three axle-joint. According to the invention the device comprises an annular bearing fixed tightly in a housing in the joint socket. The housing has a grooved surface designed to increase friction on the abutting bearing by permanent deformation of the bearing.

Documents cited in the International Search Report

D1: US 4 976 582 A
D2: US 4 695 182 A
D3: EP 0 705 990 A2

Document D1 discloses a device for movement and positioning of an element in space. The device includes end of control arms integrated by ball-and-socket joints.

Document D2 discloses a ball and socket joint with mechanical interlock.

Document D3 discloses a spherical joint with a bushing between an inner- and outer member.

The invention according to claims 1-11 differs from what is known in D1, D2 and D3 by the housing in the joint socket having a grooved surface designed to increase friction on the abutting bearing. The teaching of the prior art as disclosed in the cited documents does not lead a skilled person to the invention. Therefore, the invention defined in the claims is not obvious to a person skilled in the art.

The invention according to claims 1-11 is thus novel and is considered to involve an inventive step. The invention also has industrial applicability.

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 103371901	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/SE 99/02255	International filing date (day/month/year) 2 December 1999	(Earliest) Priority Date (day/month/year) 3 December 1998
Applicant ABB AB et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] Certain claims were found unsearchable (See Box I).

2. [ ] Unity of invention is lacking (See Box II).

3. [ ] The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] transcribed by this Authority.

4. With regard to the title,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the abstract,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:
   Figure No. 1
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

Form PCT/ISA/210 (first sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02255

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B25J 17/02, F16C 11/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B25J, F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4976582 A (CLAVEL), 11 December 1990 (11.12.90), figures --	1-12
Y	US 4695182 A (WOOD, JR.), 22 Sept 1987 (22.09.87), column 5, line 64 - column 6, line 3 --	1-12
Y	EP 0705990 A2 (THK CO. LTD.), 10 April 1996 (10.04.96), column 9, line 44 - line 55 --	1,3-4,9-11
A	US 3856423 A (UCHIDA), 24 December 1974 (24.12.74), column 3, line 66 - column 4, line 6; column 1, line 56 - line 57 --	1,5,7,11

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 February 2000	17 -04- 2000

Name and mailing address of the ISA	Authorized officer
Swedish Patent Office Box 5055, S-102 42 STOCK[redacted]M Facsimile No. +46 8 666 02 86	Christer Jön[redacted]n / MR Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02255

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4203683 A (ROGERS), 20 May 1980 (20.05.80), column 2, line 56 - line 61 -- --------	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/SE 99/02255

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4976582 A	11/12/90	AT 65200 T	15/08/91
		CA 1298806 A	14/04/92
		CH 672089 A,B	31/10/89
		EP 0250470 A,B	07/01/88
		SE 0250470 T3	
		JP 4045310 B	24/07/92
		JP 63501860 T	28/07/88
		WO 8703528 A	18/06/87
US 4695182 A	22/09/87	DE 3720137 A,C	23/12/87
		JP 2599137 B	09/04/97
		JP 62297527 A	24/12/87
		DE 3700057 A,C	16/07/87
		JP 1954745 C	28/07/95
		JP 6070442 B	07/09/94
		JP 62184217 A	12/08/87
		US 4712940 A	15/12/87
EP 0705990 A2	10/04/96	EP 0955480 A	10/11/99
		JP 8152018 A	11/06/96
		US 5653547 A	05/08/97
US 3856423 A	24/12/74	AU 475212 B	12/08/76
		AU 6524774 A	07/08/75
		BR 7400814 D	00/00/00
		CA 1007474 A	29/03/77
		DE 2326018 A,C	22/08/74
		FR 2216853 A	30/08/74
		GB 1447258 A	25/08/76
		IT 1007548 B	30/10/76
		JP 964830 C	20/07/79
		JP 49101762 A	26/09/74
		JP 53044620 B	30/11/78
US 4203683 A	20/05/80	AU 517401 B	30/07/81
		AU 3498178 A	18/10/79
		BR 7802204 A	05/12/78
		CA 1079533 A	17/06/80
		DE 2814234 A	26/10/78
		FR 2387375 A	10/11/78
		GB 1597495 A	09/09/81
		IT 1108019 B	02/12/85
		JP 53126465 A	04/11/78
		TR 20701 A	11/05/82

RECORD COPY

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REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/SE 99 / 0 2 2 5 5

International Filing Date 02 -12- 1999

The Swedish Patent Office
PCT International Application

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* 103371901

Box No. I TITLE OF INVENTION

Robot Device

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no state of residence is indicated below.)*

ABB AB

SE-721 83 VÄSTERÅS
Sweden

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: Sweden

State *(that is, country)* of residence: Sweden

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no state of residence is indicated below.)*

PERSSON Fredrik
Markörgatan 10 A
SE-723 38 VÄSTERÅS
Sweden

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: Sweden

State *(that is, country)* of residence: Sweden

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is ~~hereby~~/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Urban Petré
AB STOCKHOLMS PATENTBYRÅ , Zacco & Bruhn
Box 23101, SE-104 35 STOCKHOLM, Sweden

Telephone No. +46 8 729 95 00

Facsimile No. +46 8 31 83 15

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III **FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS**

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no state of residence is indicated below.)*

MIKAELSSON Pierre
Haga Parkgatan 3 D
SE-723 36 VÄSTERÅS
Sweden

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: Sweden

State *(i.e. country)* of residence: Sweden

This person is applicant for the purposes of:

- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no state of residence is indicated below.)*

HVITTFELDT Håkan
Brunnbygatan 64
SE-722 23 VÄSTERÅS
Sweden

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: Sweden

State *(i.e. country)* of residence: Sweden

This person is applicant for the purposes of:

- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no state of residence is indicated below.)*

LARSSON Jan
Adolf Zethelius gata 11
SE-724 78 VÄSTERÅS
Sweden

This person is:

- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: Sweden

State *(i.e. country)* of residence: Sweden

This person is applicant for the purposes of:

- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (i.e. country) of residence if no state of residence is indicated below.)*

This person is:

- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality:

State *(i.e. country)* of residence:

This person is applicant for the purposes of:

- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgystan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH** and **LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain., **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the FCT *(if other kind of protection or treatment desired, specify on dotted line)*.....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒	**AE**	United Arab Emirates	☒	**LR**	Liberia
☒	**AL**	Albania	☒	**LS**	Lesotho
☒	**AM**	Armenia	☒	**LT**	Lithuania
☒	**AT**	Austria and utility model.	☒	**LU**	Luxembourg
☒	**AU**	Australia	☒	**LV**	Latvia
☒	**AZ**	Azerbaijan	☒	**MA**	Morocco
☒	**BA**	Bosnia and Herzegovina	☒	**MD**	Republic of Moldova
☒	**BB**	Barbados	☒	**MG**	Madagascar
☒	**BG**	Bulgaria	☒	**MK**	The former Yugoslav Republic of Macedonia.
☒	**BR**	Brazil	☒	**MN**	Mongolia
☒	**BY**	Belarus	☒	**MW**	Malawi
☒	**CA**	Canada	☒	**MX**	Mexico
☒	**CH and LI**	Switzerland and Liechtenstein	☒	**NO**	Norway
☒	**CN**	China	☒	**NZ**	New Zealand
☒	**CR**	Costa Rica	☒	**PL**	Poland
☒	**CU**	Cuba	☒	**PT**	Portugal
☒	**CZ**	Czech Republic and utility model	☒	**RO**	Romania
☒	**DE**	Germany and utility model	☒	**RU**	Russian Federation
☒	**DK**	Denmark and utility model	☒	**SD**	Sudan
☒	**DM**	Dominica	☒	**SE**	Sweden
☒	**EE**	Estonia and utility model	☒	**SG**	Singapore
☒	**ES**	Spain	☒	**SI**	Slovenia
☒	**FI**	Finland and utility model	☒	**SK**	Slovakia and utility model
☒	**GB**	United Kingdom	☒	**SL**	Sierra Leone
☒	**GD**	Grenada	☒	**TJ**	Tajikistan
☒	**GE**	Georgia	☒	**TM**	Turkmenistan
☒	**GH**	Ghana	☒	**TR**	Turkey
☒	**GM**	Gambia	☒	**TT**	Trinidad and Tobago
☒	**HR**	Croatia	☒	**TZ**	Tanzania
☒	**HU**	Hungary	☒	**UA**	Ukraine
☒	**ID**	Indonesia	☒	**UG**	Uganda
☒	**IL**	Israel	☒	**US**	United States of America
☒	**IN**	India	☒	**UZ**	Uzbekistan
☒	**IS**	Iceland	☒	**VN**	Viet Nam
☒	**JP**	Japan	☒	**YU**	Yugoslavia
☒	**KE**	Kenya	☒	**ZA**	South Africa
☒	**KG**	Kyrgyzstan	☒	**ZW**	Zimbabwe
☒	**KP**	Democratic People's Republic of Korea			
☒	**KR**	Republic of Korea			
☒	**KZ**	Kazakhstan			
☒	**LC**	Saint Lucia			
☒	**LK**	Sri Lanka			

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after Issuance of this sheet:

☐ .....

☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Supplemental box *If the Supplemental Box is not used, this sheet should not be included in the request.*

1. *If, in any of the Boxes, the space is insufficient to furnish all the information: in such case, write "Continuation of Box No. ... " (indicate the number of the Box) and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular.*

(i) ***If more than two persons are involved as applicants and/or inventors*** *and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is country) of residence if no State of residence is indicated below:*

(ii) ***If, in Box No. II or in any of the sub-boxes of Box No. III, the indication*** *"the States indicated in the Supplemental Box"* ***is checked: in such case, write "Continuation of Box No II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant:***

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(iv) ***If, in addition to the agent(s) indicated in Box No IV, there are*** *further agents:* ***in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;***

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(vi) ***If, in Box No VI, there are*** *more than three earlier applications whose priority is claimed:* ***in such case, write "Continuation of Box No VI" and indicated for each additional earlier application the same type of information as required in Box No VI:***

(vii) ***If, in Box No VI,*** *the earlier application is an ARIPO application:* ***in such case, write "Continuation of Box No VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed.***

2 ***If, whit regard to the*** *precautionary designation statement* ***contained in Box No V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.***

3 ***If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning*** *non-prejudicial disclosures of exceptions to lack of novelty:* ***in such case, write "Statement concerning non-prejudicial disclosures or exceptions to lack of novelty" and furnish that statement below.***

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Further representatives:

Agvald-Glas, Gunilla
Bernhult, Lennart
Bjerndell, Per
Brundin; Gabriella
Grahn, Cecilia
Granström, Lars-Eric
Grip, Joakim
Hansson, Hans-Erik
Hansson, Sven A.
Hinz, Udo
Karlsson, Per Tomas
Lennefors, Stefan
Lundström, Maria
Nilsson, Brita
Nordén, J. Åke
Onn, Thorsten
Petré, Urban
Rilton, Kristina
Westerlund, Örjan
Åström, Elsa

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application: * regional Office	international application: receiving Office
item (1) 3/12/98 3 December 1998	9804215-3	SE		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): (1)

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

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Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA /SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date (day/month/year)	Number	Country (or regional Office)
3/12/98	SE 98/01385	SE

RO/SE

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:5
description (excluding sequence listing part)	:3
claims	:2
abstract	:1
drawings	:5
sequence listing part of description	:
Total number of sheets:	16

This international application is **accompanied** by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☒ copy of general power of attorney; reference number, if any: PGF 3460/99
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: List of representatives , ITS

Figure of the drawings which should accompany the abstract: Fig. 1

Language of filing of the international application: Swedish

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Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Stockholm, 2 December 1999

Urban Pétré

Representative of the applicant

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4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA / SE	☐ 6. Transmittal of search copy delayed until search fee is paid	

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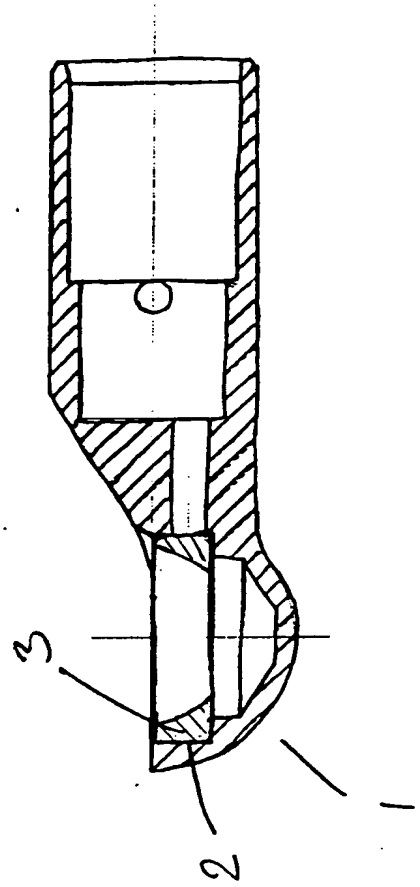

fig 1

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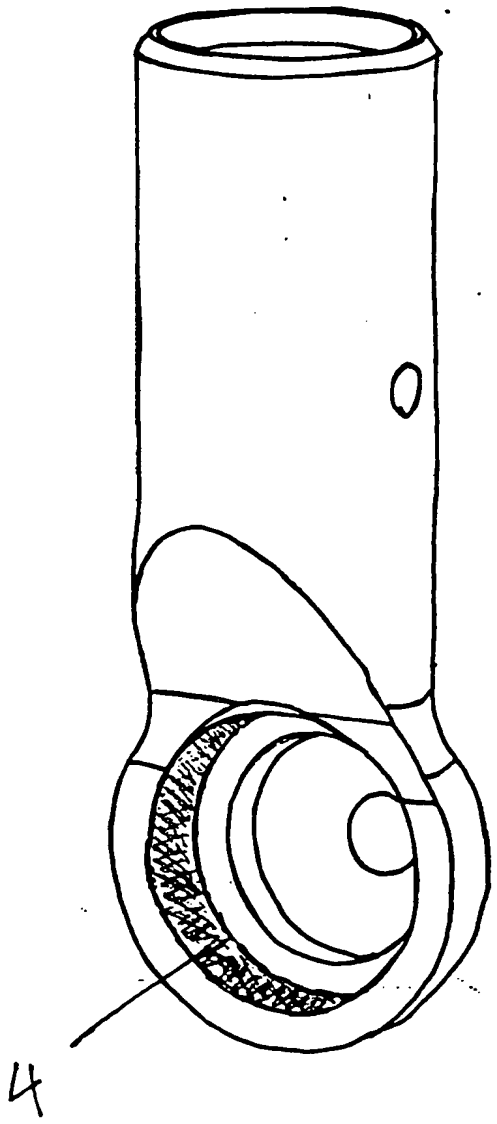

fig 2

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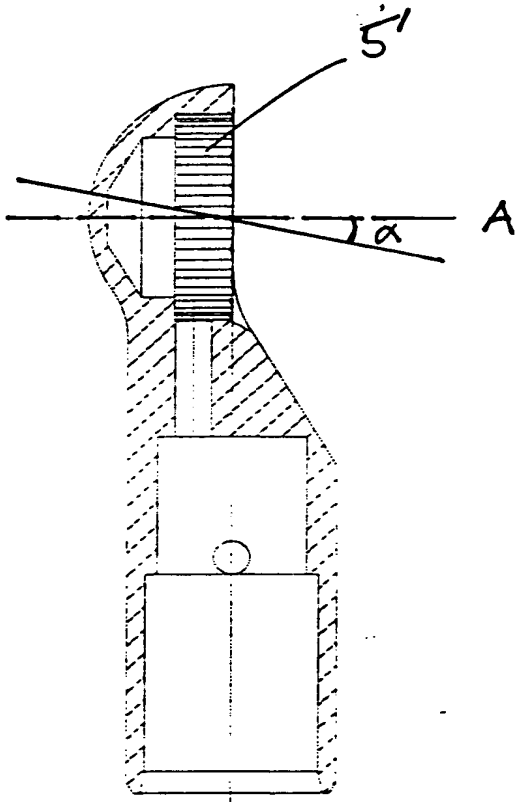
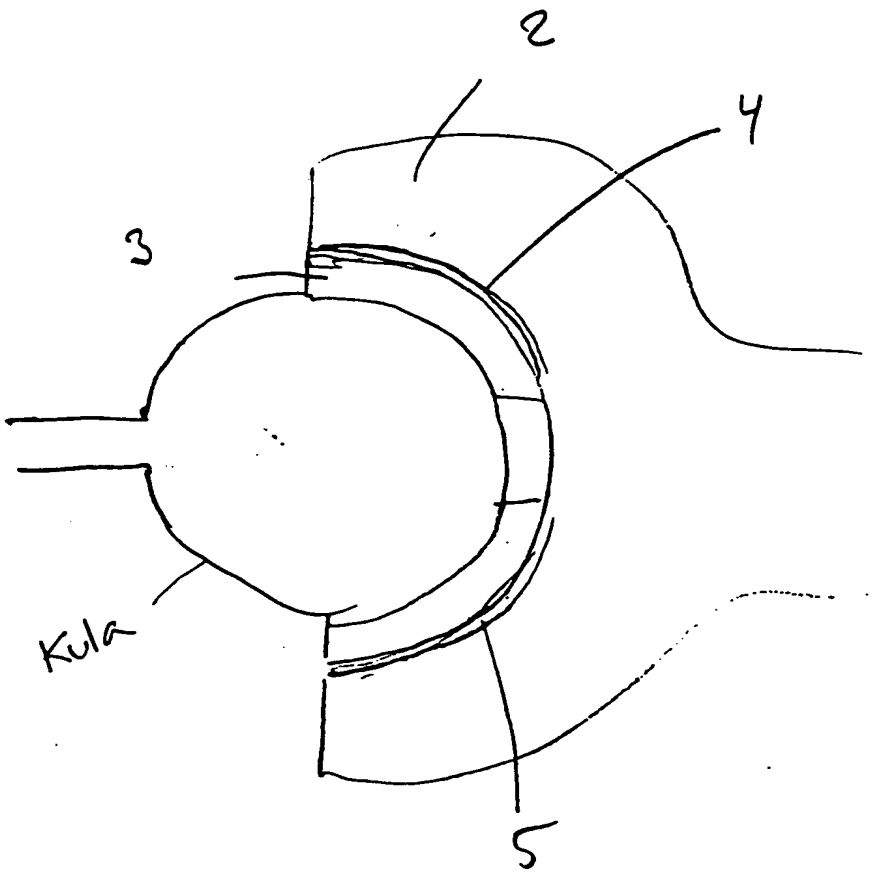


fig 3



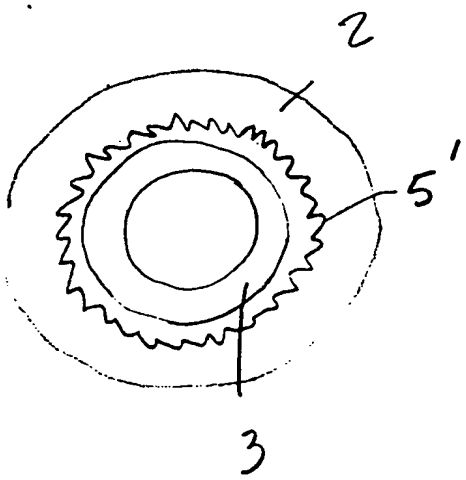


fig 4

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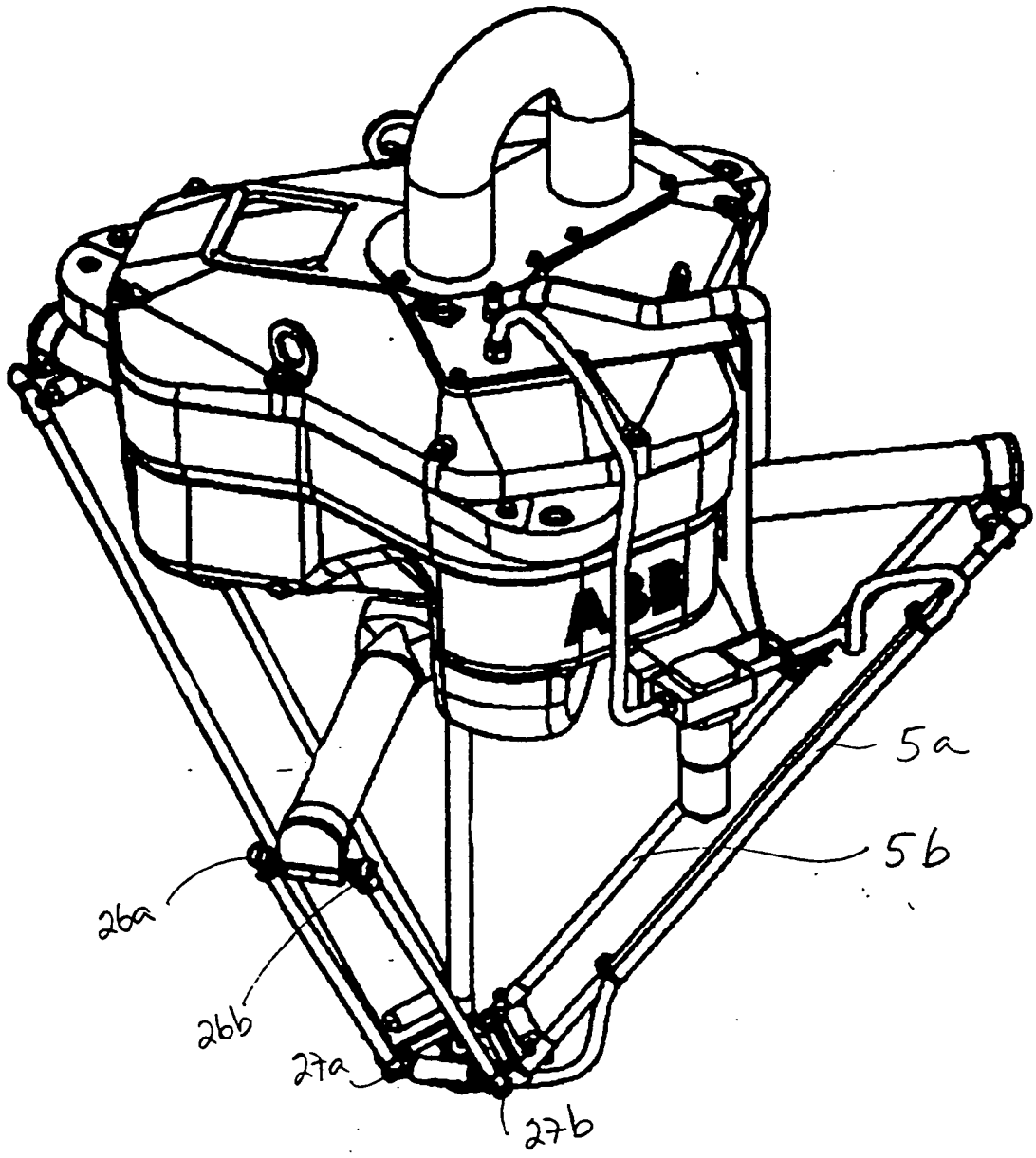

FIG. ✱ 5

KN 8565 WO/JS

1999-11-25

ROBOT DEVICE

TEKNISKT OMRÅDE

Föreliggande uppfinning hänför sig till en anordning, användning och ett förfarande för att i en treaxlig led i en robot eliminera risken för glapp.

TEKNIKENS STÅNDPUNKT

Vid deltarobotar sker en positionering av ett rörligt element i förhållande till ett fast element (fig 5). Tre drivanordningar driver varsin länkanordning anordnad mellan det fasta och det rörliga elementet. Länkanordningarna kan innefatta stag anordnade i flerledssystem, där lederna kan utgöras av kula-skål-leder.

I den amerikanska patentskriften US,A, 4 976 582 visas bland annat en deltarobot med två parallella länkar 5a och 5b ledat förbundna med kula-skål-leder 26a, 26b, 27a och 27b (fig 5). Ledskålarna är fästade i ändarna på länkarna.

Kula-skål-lederna enligt uppfinningen är utformade med utbytbara lager som minimerar friktionen i leden. Lagret har en skålformad inneryta och är tillverkat av självsmörjande polymermaterial. Lagret är anordnat i ett säte i ledskålen. Under drift av roboten sker dels ledrörelser i kula-skål-lederna och dels rotationsrörelser.

Problem uppstår när lagret följer med rotationsrörelsen dvs följer med ledkulans rotationsrörelse. Härvid sker ledrörelserna vid samma radier hos ledskålen vid varje slag hos länkanordningen, varvid nötning sker upprepade gånger på samma ställen. Ett ojämnt slitage uppstår i leden, vilket förorsakar glapp i leden och därmed ökad friktion i leden. Orsaken till att lagret roterar med ledkulan är att materialet i lagret är för mjukt för att en bra presspassning i sätet ska kunna säkras.

En robot som innefattar led / leder med glapp klarar inte en jämn gång utan störs i sin rörelse eftersom lederna kärvar och rörelserna blir oprecisa. Momentjämvikten i konstruktionen störs, vilket sänker robotens livslängd drastiskt. Slagtiderna förlängs och roboten klarar inte prestandakraven.

Vid drift av deltarobotar uppkommer därmed behovet av att fixera ett lager i ett säte i ledskålen. Detta behov kan inte deltaroboten i den amerikanska patentskriften uppfylla.

REDOGÖRELSE FÖR UPPFINNINGEN

Vid konstruktion av deltarobotar är syftet enligt uppfinningen att åstadkomma konstruktioner med låg vikt vilka klarar slagtider på 0.5 sekunder. För att uppnå så snabba robotar måste lederna utformas så att friktionen är minimerad.

Ett visst slitage av ett lager i en led är ofrånkomligt. Ett jämnt slitage av ett självsmörjande lager ger en jämn smörjning av och en jämn rörelse i leden. Vid ett jämnt slitage uppstår inga oönskade glapp och roboten får en jämn och snabb gång.

Syftet med föreliggande uppfinning är således att åstadkomma en robot innefattande en anordning med vilken man ökar friktionen mellan lager och ledskål i en kula-skål-led. Ett ytterligare syfte med uppfinningen är utforma anordningen så att den möjliggör ett enkelt byte av lager efter behov.

FIGURBESKRIVNING

Uppfinningen kommer att förklaras närmare genom beskrivning av ett utföringsexempel under hänvisning till bifogade ritning, där

fig 1 visar en ledskål enligt uppfinningen,

fig 2 visar en ledskål enligt uppfinningen,

fig 3 visar en ledskål enligt uppfinningen anordnad med rillor,

fig 4 visar en alternativ utformning med skålformat säte och lager,

fig 5 visar en deltarobot.

BESKRIVNING AV UTFÖRINGSEXEMPEL

En treaxlig kula-skål-led i en robot (fig 5) utgörs av en ledskål och en ledkula. Ledskålen (1) omsluter ledkulan (inte visad) med ett utrymme som utgör en halv sfär eller mindre (fig 1). I ledskålen (1) är ett säte (2) utformat för att hysa ett lager (3).
Bestämningen lager avser här endera en lagerring, flera lagerringar eller lagret uppdelat i sektioner på något för behovet lämpligtvis. I det här nedan beskrivna utföringsexemplet utgörs lagret av en lagerring.

Sätet (2) innefattar en yta (4) mot vilken lagerringen (3) presspassas (fig 2). Lagerringen (3) är tillverkad av ett polymermaterial och presspassas på plats med hjälp av verktyg på sedvanligt sätt. För att öka friktionen mellan ledskålens yta (4) och lagerringen (3) anordnas friktionshöjande organ (5) på ytan (4). De friktionshöjande organen kan utformas såsom exempelvis en vågstruktur i form av rillor (5´) (fig 3). Rillornas (5´) riktning i längsled bildar vinkeln (α) med lagerringens centrumaxel (A). Rillorna (5´) är företrädesvis parallella med centrumaxeln (A). Rillorna bör dessutom ha spetsiga toppar för att säkerställa friktionen. När

lagerringen (3) anordnas i sätet (2) åstadkommer de friktionshöjande organen (5) en plastisk deformation av lagerringen (3) genom att tränga in i dennas material.

En alternativ utformning av uppfinningen är att göra lagrets mantelyta kompatibel mot de friktionshöjande organen (5) anordnade på ledskålens yta (4). I den ovan beskrivna utföringsformen med friktionshöjande organ (5) i form av rillor (5') kan lagret (3) därmed alternativt utformas med till sätets yta kompatibla rillor.

En ytterligare alternativ utformning av uppfinningen är att utforma ledskålens säte skålformat och försett med rillor. Lagret utformas då med en skålformad ytteryta och placeras utan presspassning i ledskålens säte. I den här utformningen av uppfinningen är det den fjäderkraft som håller ihop kula-skål-leden som även fixerar lagret.

PATENTKRAV

1 Robot innefattande minst en länkanordning i vilken stag är anordnade i flerledssystem där lederna innefattar treaxliga kula-skål-leder k ä n n e t e c k n a d a v att ett lager (3) är fixerat mot rotation i ett säte (2) i en leds ledskål (1), vilket säte (2) innefattar en yta (4) mot vilken lagret (3) anligger och att ytan (4) är utformad med friktionshöjande organ (5).

2 Anordning enligt patentkrav 1 k ä n n e t e c k n a d a v att lagret (3) utgörs av en lagerring (3´).

3 Anordning enligt patentkrav 1-2 k ä n n e t e c k n a d a v att de friktionshöjande organen (5) genom en plastisk deformation av lagret (3) inträngер i dennas material.

4 Anordning enligt patentkrav 1-3 k ä n n e t e c k n a d a v att de friktionshöjande organen (5) är utformade i form av rillor (5´).

5 Anordning enligt något av patentkraven 1-4 k ä n n e t e c k n a d a v att lagret (3) anligger med presspassning mot ytan (4).

6 Anordning enligt patentkrav 4 k ä n n e t e c k n a d a v att rillorna (5´) är riktade huvudsakligen parallellt med lagrets centrumaxel (A).

7 Anordning enligt patentkraven 1-6 k ä n n e t e c k n a d a v att lagret är tillverkad av ett polymermaterial.

8 Anordning enligt något av patentkraven 1-7 k ä n n e t e c k n a d a v att roboten är en deltarobot.

9 Förfarande för att i en robot innefattande minst en länkanordning i vilken stag är anordnade i flerledssystem, vilka leder innefattar treaxliga kula-skål-leder och där en leds ledskål (1) bringas att innefatta ett säte (2) för att mottaga ett lager (3), vilket säte (2) bibringas en yta (4) mot vilken lagret anligger k ä n n e t e c k n a t a v att lagret (3) fixeras mot rotation i sätet (2) genom att ytan (3) förses med friktionshöjande organ (5) vilka bringas i grepp med lagret (3) när lagret (3) inpassas på plats.

10 Förfarande enligt patentkrav 9 k ä n n e t e c k n a t a v att lagret (3) presspassas på plats i ledskålens (1) säte (2).

11 Förfarande enligt patentkrav 9 k ä n n e t e c k n a t a v att de friktionshöjande organen (5) plastiskt deformerar lagrets material när lagret (4) passas på plats.

12 Användning av en anordning enligt krav 1 och ett förfarande enligt krav 9 för fixering av ett lager i en robot innefattande minst en länkanordning i vilken stag är anordnade i flerledssystem där lederna innefattar treaxliga kula-skål-leder.

5

10

SAMMANFATTNING

Anordning för fixering av ett lager i en treaxlig kula-skål-led anordnad i en robot. Lagret är
15 anordnat i ett säte (2) på ledskålen (1) och sätet (2) innefattar en yta (3) mot vilken lagret anligger . Ytan (3) är utformad med friktionshöjande organ (4) vilka greppar tag i lagret och håller fast det.

20 (fig 1)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

AB Stockholms Patentbyrå,
Zacco & Bruhn
Box 23101
104 35 STOCKHOLM

STOCKHOLMS PATENTBYRÅ
2000 -04- 18
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NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 103371901	Date of mailing *(day/month/year)* 17 -04- 2000 FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/SE99/02255	International filing date *(day/month/year)* 02-12-1999
Applicant ABB AB et al	

1. [X] The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report: however, for more details, see the notes on the accompanying sheet.

Where? To the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see notes on the accompanying sheet.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. [ ] With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

[ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

[ ] no decision has been made yet on the protest: the applicant will be notified as soon as a decision is made.

4 Further action(s): The applicant is reminded of the following.

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

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(See notes on accompanying sheet)

Form PCT/ISA/220 (January 1994)

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(71) Applicant (*for all designated States except US*): ABB AB [SE/SE]; S-721 83 Västeras (SE).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): PERSSON, Fredrik [SE/SE]; Markörgatan 10 A, S-723 38 Västerås (SE). MIKAELSSON, Pierre [SE/SE]; Haga Parkgatan 3D, S-723 36 Västerås (SE). HVITTFELDT, Håkan [SE/SE]; Brunnbygatan 64, S-722 23 Västerås (SE). LARSSON, Jan [SE/SE]; Adolf Zethelius gata 11, S-724 78 Västerås (SE).

(74) Agents: URBAN, Pernö et al.; AB Stockholms Patentbyrå, Zacco & Bruhn, P.O. Box 23101, S-104 35 Stockholm (SE).

(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
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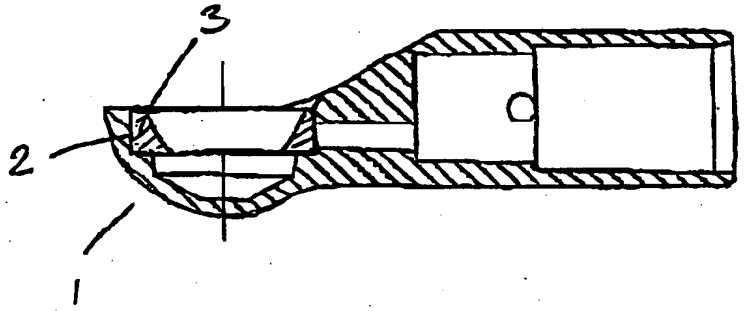
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
In English translation (filed in Swedish).

(54) Title: ROBOT DEVICE



(57) Abstract

Device for fixing a bearing means firmly in a three-axle ball and socket joint arranged in a robot. The bearing means is arranged in a housing (2) on the joint socket (1) and the housing (2) includes surface (4) against which the bearing means abuts. Surface (4) is designed with friction-increasing means (5) that grip the bearing means and hold it.

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CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

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JC Rec'd PCT/PTO 04 JUN 2001
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ROBOT DEVICE

TECHNICAL FIELD

The present invention relates to a device, use and method to eliminate the risk of play in a three-axle joint in a robot.

PRIOR ART

In a delta robot, a positioning of a moveable element in relation to a fixed element takes place (Fig. 5). Three driving means each drive their own link device arranged between the fixed and the moveable elements. The link devices can include rods arranged in multi-joint systems where the joints can comprise ball and socket joints.

The American document US,A, 4 976 582 shows, among other things, a delta robot with two parallel links 5a and 5b joined to pivot with ball and socket joints 26a, 26b, 27a, and 27b (Fig. 5). The joint sockets are attached to the ends of the links.

The ball and socket joints according to the invention are designed with replaceable bearing means that minimise friction in the joints. The bearing means has a socket-shaped inner surface and is manufactured in self-lubricating polymer material. The bearing means is arranged in a seat in the joint socket. During the operation of the robot, rotational movements take place in the ball and socket joints and directional movements also occur.

Problems arise when the bearing means follows the rotational movement, i.e. follows the rotation movement of the ball of the joint. In this situation, link movements take place at the same radii take place at the joint socket at each stroke of the linkage device, whereby wear occurs repeatedly at the same location. An uneven wear occurs in the joint, which causes play in the joint and thus increased friction in the joint. The reason that the bearing

means rotates with the ball joint is that the material in the bearing means is too soft to ensure a good tight fit in the seat.

A robot including a joint / joints with play does not work at a smooth pace but is disturbed in its movement as the joints bind and the movements become imprecise. The balance of moments in the construction is disturbed, which drastically reduces the working life of the robot. The cycle time increases and the robot cannot meet its performance requirements.

In the operation of robots, the need thus arises to firmly fix a bearing means in a seat in a joint socket. This need cannot be met by the delta robot in the American document.

SUMMARY OF THE INVENTION

When designing delta robots, the objective according to the invention is to achieve a design with a low weight that can handle a stroke time of 0.5 seconds. To achieve robots that are this fast, the joint must be designed so that friction is minimised.

A certain wear on the bearing means in a joint is unavoidable. An even wear of a self-lubricating bearing means gives an even lubrication of and a smooth movement in the joint. When the wear is even, no unwanted play occurs and the robot has a smooth, rapid operation.

The object of the present invention is thus to achieve a robot including a means with which one increases the friction between bearing means and socket in a ball and socket joint. An additional object of the invention is to design the device so that it allows an easy replacement of bearing means according to need.

DESCRIPTION OF THE DRAWING

The invention will be explained in greater detail by describing an example of an embodiment with reference to the enclosed drawings, where;

Fig. 1 shows a socket of a joint according to the invention,

Fig. 2 shows a joint socket according to the invention,

Fig. 3 shows a joint socket according to the invention arranged with grooves,

Fig. 4 shows an alternative design with a socket-shaped seat and bearing means,

Fig. 5 shows a delta robot.

DESCRIPTION OF EMBODIMENTS

A three axle ball and socket joint in a robot (Fig. 5) comprises a joint socket and a joint ball. The joint socket 1 encloses the ball of the joint (not shown) with a space that comprises approximately a half of a sphere or less (Fig. 1). A housing 2 shaped to accommodate a bearing means 3 is located within socket 1.
The word bearing here relates to either one annular bearing, several annular bearings or the bearing divided into sections in a way suitable for the purpose. In the embodiment described below, the bearing means comprises one annular bearing means.

The housing 2 includes a surface 4 against which the annular bearing means 3 is pressed to fit tightly (Fig. 2). Annular bearing means 3 is manufactured from a polymer material and is pressed to fit tightly in place with the aid of a tool in the traditional manner. To increase the friction between surface 4 of the joint socket and the annular bearing means 3, friction-increasing means 5 are arranged on the surface 4. The friction-increasing means can be designed as, for example, a wave structure in the form of grooves 5´ (Fig. 3). The orientation of the grooves 5´ in a longitudinal direction forms the angle (α) with the centre axis (A) of the annular bearing means. Grooves 5´ are preferably parallel with the centre axis (A). In addition, the grooves should have sharply pointed tops to secure the friction. When the annular bearing means 3 is arranged in the housing 2, the friction-increasing

means 5 achieve a permanent deformation of the annular bearing means 3 by penetrating its material.

An alternative design of the invention is to make the envelope surface of the bearing means compatible to the friction-increasing means 5 arranged on the surface of the joint socket 4. In the embodiment described above with the friction-increasing means 5 in the form of grooves 5´, the bearing means 3 can thus be alternatively designed with grooves that are compatible with the surface of the housing.

A further alternative design of the invention is to design the housing of the joint socket socket-shaped and provided with grooves. Then the bearing means is designed with a socket-shaped outer surface and is placed without being pressed to fit tightly in the housing of the joint socket. In this design of the invention, it is the spring force that holds the ball and socket joint together that also fixes the bearing means firmly in place.

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CLAIMS

1. Robot including at least one linkage device in which pull rods are arranged in a multi-joint system where the joints include three-axle ball and socket joints c h a r a c t e r i s e d in that a bearing means (3) is fixed so that it does not rotate in a housing (2) in the socket of a joint (1), where housing (2) includes a surface (4) against which the bearing means (3) abuts and that the surface (4) is designed with friction-increasing means (5).

2. Device according to claim 1 c h a r a c t e r i s e d in that the bearing means (3) comprises an annular bearing means (3´).

3. Device according to claims 1-2 c h a r a c t e r i s e d in that the friction-increasing means (5) penetrate its material by a permanent deformation of the bearing means (3).

4. Device according to claims 1-3 c h a r a c t e r i s e d in that the friction-increasing means (5) are designed in the form of grooves (5´).

5. Device according to claims 1-4 c h a r a c t e r i s e d in that bearing means (3) abuts with surface (4) and is pressed to fit tightly.

6. Device according to claim 4 c h a r a c t e r i s e d in that grooves (5´) are oriented primarily parallel with the central axis (A) of the bearing means.

7. Device according to claims 1-6 c h a r a c t e r i s e d in that the bearing means is made of a polymer material.

8. Device according to any of claims 1-7 c h a r a c t e r i s e d in that the robot is a delta robot.

9. Method for a robot including at least one linkage device in which pull rods are arranged in a multi-joint system where the joints include three-axle ball and socket joints and where a socket (1) of a joint is provided with a housing (2) to accommodate a bearing

means (3), where the housing (2) is provided with a surface (4) against which the bearing means abuts c h a r a c t e r i s e d in that bearing means (3) is fixed so that it does not rotate in housing (2) by providing surface (4) with friction-increasing means (5) that are brought to engage with bearing means (3) when bearing means (3) is positioned in place.

10. Method according to claim 9 c h a r a c t e r i s e d in that the bearing means (3) is pressed to fit tightly in place in the housing (2) of the joint socket (1).

11. Method according to claim 9 c h a r a c t e r i s e d in that friction-increasing means (5) deform the material of the bearing means by permanent deformation when bearing means (3) is placed in position.

12. Use of a device according to claim 1 and a method according to claim 9 for fixing the location of a bearing means in a robot including at least one linkage device in which rods are arranged in a multi-joint system where the joints include three-axle ball and socket joints.

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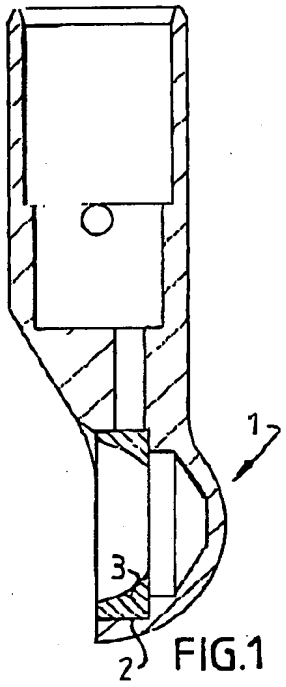

FIG.1

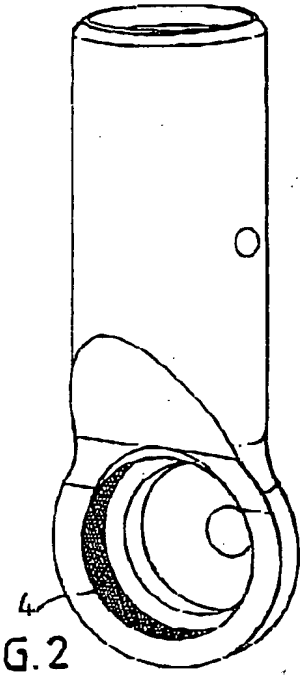

FIG.2

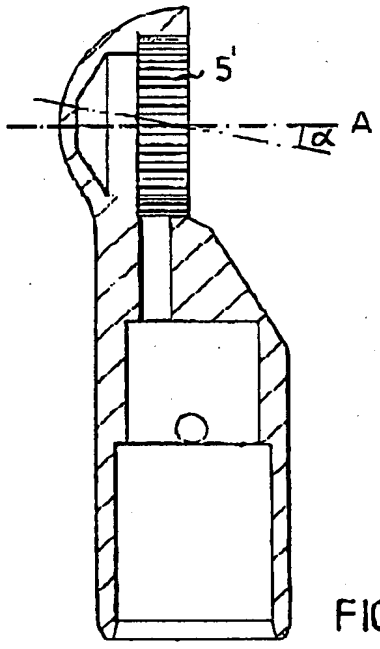

FIG.3

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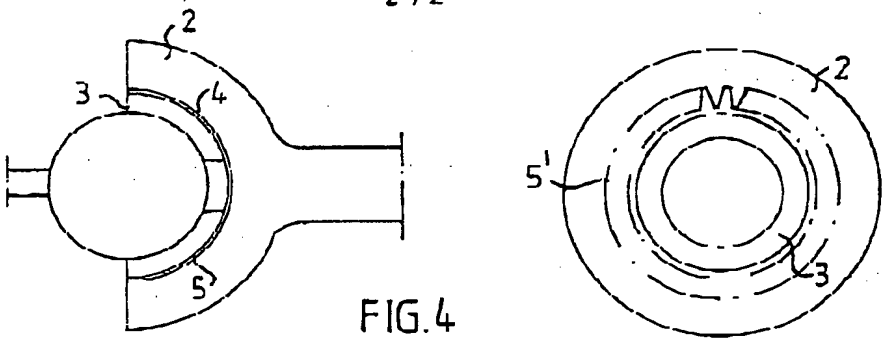

FIG.4

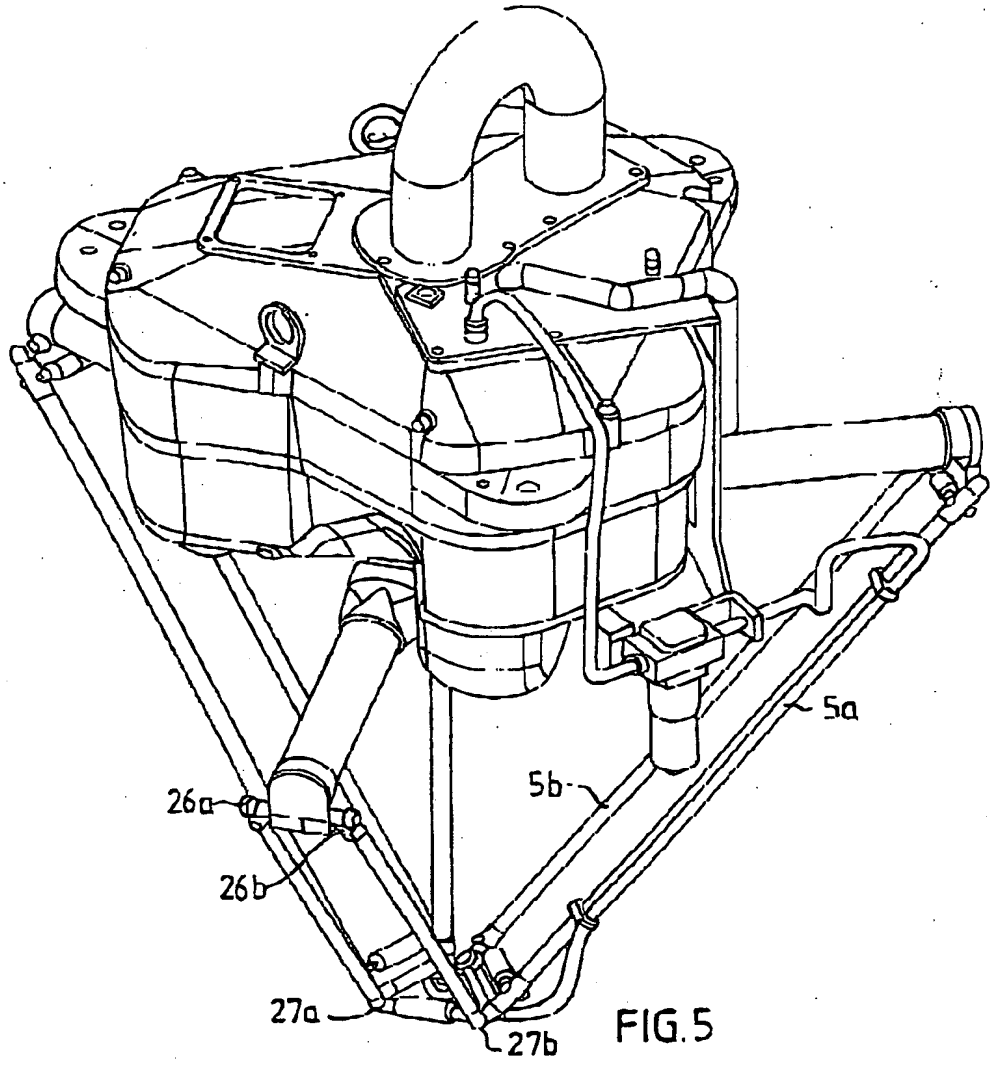

FIG.5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02255

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B25J 17/02, F16C 11/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B25J, F16C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4976582 A (CLAVEL), 11 December 1990 (11.12.90), figures --	1-12
Y	US 4695182 A (WOOD, JR.), 22 Sept 1987 (22.09.87), column 5, line 64 - column 6, line 3 --	1-12
Y	EP 0705990 A2 (THK CO. LTD.), 10 April 1996 (10.04.96), column 9, line 44 - line 55 --	1,3-4,9-11
A	US 3856423 A (UCHIDA), 24 December 1974 (24.12.74), column 3, line 66 - column 4, line 6; column 1, line 56 - line 57 --	1,5,7,11

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 February 2000	17 -04- 2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Christer Jönsson / MR Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/SE 99/02255

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